

OX-4261
COPY 1 OF 2

RELIABILITY ESTIMATE

PROTOTYPE EQUIPMENT TYPE 1a and 1b
SPO 71945
DOCUMENT NO. 449

November 6, 1962

DOC. NO.	474
TOTAL PAGES	9
COPY	1 OF 2

FOR INTERNAL USE ONLY

STATINTL

Prepared By

Approved By

Revision Preliminary-A

Copy _____ of _____ copies

Number of Pages 9

2.0 GENERAL

In a series reliability configuration the probability of satisfactory performance of the system (P_s) is equal to the multiplication of the probabilities of each component in the system.

$$P_s = P_1 \cdot P_2 \cdot P_3 \cdot P_4 \cdots P_n$$

The probability of satisfactory performance of a component

$$P = e^{-\lambda t}$$

where

e = Base of Natural Log

λ = Part Failure Rate

t = Operating Time

Therefore,

$$P_s = e^{-\lambda_1 t} \cdot e^{-\lambda_2 t} \cdot e^{-\lambda_3 t} \cdots e^{-\lambda_n t}$$

$$P_s = e^{-t(\lambda_1 + \lambda_2 + \lambda_3 + \cdots + \lambda_n)}$$

$$\lambda_1 + \lambda_2 + \lambda_3 + \cdots + \lambda_n = \lambda_T \text{ (total part failure rate)}$$

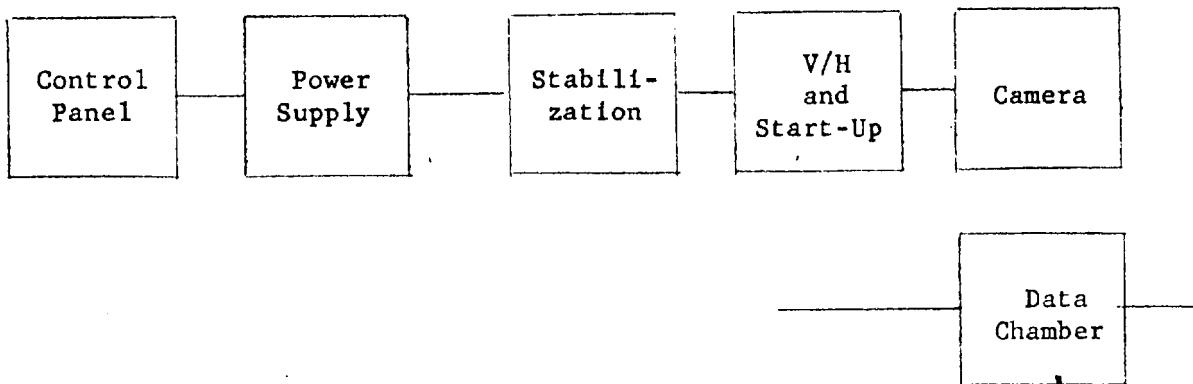
$$P_s = e^{-\lambda_T t}$$

The mean time between failure (MTBF) of a system is defined as reciprocal of the total part failure.

$$MTBF = \frac{1}{\lambda_T}$$

3.0 RELIABILITY ESTIMATE

3.1 Reliability Block Diagram



3.2 Calculation of Part Failure Rate

3.2.1 Control Panel

<u>Part Name</u>	<u>Part Failure Rate (%/1000 Hours)</u>
Control Panel	<u>1.949</u>
Total	<u>1.949</u>
MTBF	= 51,308 Hours

3.2.2 Power Supply

<u>Part Name</u>	<u>Part Failure Rate (%/1000 Hours)</u>
A.C. Power Supply	.750
D.C. Power Supply	<u>4.355</u>
Total	<u>5.085</u>
MTBF	= 19,665 Hours

3.2.3 Stabilization

<u>Part Name</u>	<u>Part Failure Rate (%/1000 Hours)</u>
Stabilization	50.862
Roll Weight Shifter	.673
Pitch Weight Shifter	.673
Cager	<u>.925</u>
Total	<u>53.133</u>
MTBF	= 1,882 Hours

3.2.4 Camera

<u>Part Name</u>	<u>Part Failure Rate (%/1000 Hours)</u>
Supply and Tension Sensor #1	10.340
Take-Up and Tension Sensor #3	10.340
Fwd and Aft Capstan Drives	
and Tension Sensor #2	
and Metering Roller	12.752
Fwd Slit Width and Capping Shutter	2.183
Aft Slit Width and Capping Shutter	2.183
Fwd Scanner	7.415
Aft Scanner	9.989
Fwd Shuttle	10.568
Aft Shuttle	10.676
Synchronizer	<u>13.005</u> Total = <u>89.451</u> MTBF = <u>11,118 Hours</u>

3.2.5 V/H and Start-Up

No information available at this time.

3.2.6 Data Chamber and Timing Dots

<u>Part Name</u>	<u>Part Failure Rate (%/1000 Hours)</u>
Data Chamber	9.084
Timing Dots	<u>1.672</u> Total = <u>10.756</u> MTBF = <u>9,297 Hours</u>

3.3 System Mean Time Between Failure

Control Panel MTBF = 51,308 $\lambda = 1.949$	Power Supply MTBF = 19,665 $\lambda = 5.085$	Stabilization MTBF = 1,882 $\lambda = 53.133$	V/H and Start-Up MTBF = $\lambda =$	Camera MTBF = 1,118 $\lambda = 89.451$
---	--	---	---	--

MTBF is in hours.

λ is in %/1000 hours.

Total part failure rate = 149.618%/1000 Hours.

System MTBF = 668 Hours*

3.4 Probability of Satisfactory Performance

Curve 1 gives the probability of satisfactory performance for various operating hours from 0 to 1000 hours.

Curve 2 gives the probability of satisfactory performance for various operating hours from 0 to 100 hours.

Curve 3 gives the probability of satisfactory performance for various operating hours from 0 to 10 hours.

*Excluding V/H and Start-Up

